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EXTENSION BULLETIN NO. 27

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A Field of Flax in Bloom

FLAX GROWING

By Coates P. Bull

FLAX NOT HARD ON THE LAND

It has long been thought that the growing of flax was hard on the land. This idea has no foundation and there is no reason for adhering to it. The idea has gained acceptance because of decreased production but this decrease does not mean that flax has been harder on the land than other crops would have been. The decrease results largely from two causes. One of these is flax wilt, a fungous disease, which kills the young plants and saps the vigor of the older ones. The other is the meager root system of the flax, which demands a large amount of available plant food. For these reasons, flax will do best upon a soil in which there is a large percentage of organic matter; a soil well supplied

with moisture and free from flax wilt. These conditions are under the control of the farmer.

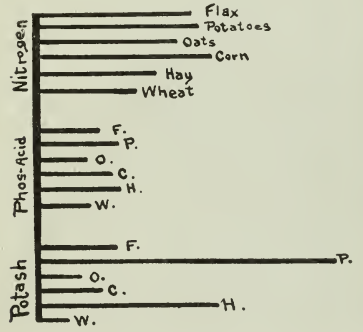
subduing the virgin sod. Little or no attention has been given to the betterment of the crop by seed selection or

Plant Food Removed in the Straw and Grain

Compiled from Bulletin No. 47 of the Minnesota Agricultural Experiment Station

Crop	Yield per acre	Nitrogen	Phosphoric acid	Potash	Lime	Silica	Total ash
	Bu.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Wheat	20	35	20	35	8	116	210
Barley	40	40	20	38	9	72	216
Oats	50	50	18	45	11	75	205
Corn	65	75	20	60	12	90	200
Peas	30	*	25	60	75	10	240
Mangels	10 T.	75	35	150	30	10	350
Meadow Hay	1 T.	30	20	45	12	50	175
Red Clover Hay	2 T.	*	28	66	75	15	250
Potatoes	150	40	20	75	25	4	125
Flax	15	54	18	27	16	3.5	87

*Contributed nitrogen to the soil.



Relative Amounts of Nitrogen, Phosphoric Acid, and Potash Removed by an Average Crop

Flax removes less phosphoric acid, potash, silica, and total ash than any other crop included in the table. It removes less nitrogen than corn, and only a little more lime than the cereals. It is not, therefore, relatively hard on the soil.

FLAX A PIONEER

For the past half-century flax has been raised almost exclusively on raw lands, for the purpose of getting some cash returns and at the same time

preparation of the seed bed. As the uplands have been claimed for other crops, flax-growing has been confined to the lower areas, such as drained sloughs or lake beds. Within the past few years many of these have been drained, and thus kept permanently under cultivation. The flax area and production has correspondingly decreased, especially during the last two or three years. From the statewide viewpoint this is a mistake. Minnesota is recognized as a great agricultural state because of its great diversity of crops and agricultural resources. If we permit a decline in one of our most valuable crops, our State will suffer loss. The next table shows the decreased production and yield, and the increase in the price per bushel. Although no reliable figures are now available for 1911, it is well known that the amount produced is much smaller than for 1910, and our seed supply is alarmingly low.

RESULTS AT UNIVERSITY FARM

Results at University Farm show conclusively that flax yields are profitable, when the crop is given reason-

Minnesota Flax Yields and Prices

Year	Acreage	Production	Yield	Price
1902.....	667,500	6,942,000	10.4	$1.07
1903.....	607,425	6,013,508	9.9	.83
1904.....	537,356	5,803,445	10.8	1.01
1905.....	449,008	5,073,790	11.3	.86
1906.....	431,048	4,741,528	11.0	1.03
1907.....	474,000	4,978,000	10.5	.98
1908.....	427,000	4,526,000	10.6	1.20
1909.....	450,000	4,500,000	10.0	1.50
1910.....	472,000	3,540,000	7.5	2.30

Compiled from Year Books of the United States Department of Agriculture, 1902-1910

ably good attention. The average yield has been about 19 bushels per acre under ordinary conditions. Still larger yields are possible anywhere in southern and western Minnesota, where the soil is heavier and naturally contains a larger percentage of organic matter.

According to Bulletin No. 97, of the Minnesota Agricultural Experiment Station, the average cost of producing flax is about $7 per acre, and the table shows much greater money returns than this, so even the average yields in our State return a fair net profit. If we regard the plowing of the areas usually seeded to flax as preparatory to reclaiming lands for other crops, and not, therefore, chargeable to the flax, the flax becomes a still better cash crop. Flax as ordinarily grown is very cheaply produced. It is not necessary to confine the production of flax to newly-turned virgin lands. Its production at a good net profit is possible on so-called "old lands."

FLAX FOR OIL

The oil mills at Minneapolis and Redwing have an aggregate capacity of sixteen million bushels of flax seed annually. The annual production of flax seed in the Northwest does not exceed twelve million bushels, which is nearly 90 per cent of the total production in the United States. Further than this, the milling interests inform us that Northwestern flax produces an oil of better quality than flax from India, Argentine or any other country.

These statements, coupled with the fact that oil meal, oil cake and other by-products of the oil mills are highly desirable as food for stock on our Minnesota farms, should lead to a greater production. The fiber of the flax straw also has a commercial value, and is now being sought by several concerns in the State. Flax is a crop well worthy of being included in our system of cropping even when we cease to have new lands to bring into cultivation. It is a good cash crop. It helps to distribute labor on the farm. It enters well into rotation and cropping systems. It is not hard on land. Its oil is needed in making paint and many other useful products. Its by-products are needed upon the farm, for their feeding value and for the fertilizing value of the manure from animals fed on oil meal. The fiber is becoming more valuable and useful. For these reasons we would be open to criticism if we should permit flax culture to decline further.

FLAX FOR FIBER

Growing flax for fiber in the United States is regarded as a minor consideration. The relatively high price received for the seed, the high price

A Field of Flax Ready for Harvesting

of labor, the irresponsibility of labor, and the high land values, all tend to mitigate the desire to grow flax for its fiber. The lack of machinery for pulling the flax (the best method of harvesting for fiber), and the lack of knowledge of flax-fiber production, also work against it. On the other hand, despite the idea that flax is hard on the soil, the adaptability of flax for reclaiming virgin prairie sod lands, and at the same time winning a net profit, has greatly stimulated the growing of flax for its seed alone.

THE SOIL

Flax will grow on any soil, whether sandy loam or clay that has enough organic matter (humus) and water. Soils low in fertility or available plant-food elements must be brought into suitable condition by rotation of crops, seeding down to timothy and clover, or by manuring. The first two plans, obviously occupy two or more years in preparation. The manuring may be done for the preceding crop, as for corn, or it may be done expressly for the flax as on meadow pasture plowed in the fall, or stubble. When applied especially for the flax crop a lighter application is advised than when one year intervenes, as in the other case. Heavy applications will have a tendency to cause too rank a growth, at the expense of the seed crop. Green manure crops, such as fall rye, field peas, or clover seeded with grain in the spring and plowed under in the fall, will also be found helpful in supplying plant food, especially organic matter.

Preparing the Soil

The virgin sod lands are not usually prepared before sowing the seed. The plowing is sometimes done the year previous to sowing the seed, in which case the soil should be thoroughly disked and rolled or otherwise packed. This will give a better seed-bed and a greater assurance of capillarity than is experienced in the usual manner of treating the soil. On spring-plowed land the preparation should be even more thorough, for the danger of

failure through the drying out of the furrow-slice is much greater.

The upturned sod should be double-disked lengthwise of the furrow, and then cross-disked. This makes a good seed-bed, opens the surface to the action of air and sunshine, and packs the furrow-slice firmly against the furrow-pan. It cannot be too strongly stated that the added labor and cost thus expended will be more than doubly repaid by the flax crop and by whatever crops may follow flax in the succeeding two or three years. The writer has seen many a patch of flax sown directly upon the upturned native sod furrow, without any further preparation. This is not a safe practice. Failure may result from this method, when a little extra time and labor in harrowing and disking would make a successful and very profitable return.

On old lands the methods used in the preparation of the soil must differ with conditions. If the field be an up-turned meadow or pasture (the best place for flax on old land) the plowing should be deep, and done in the fall. In the spring, disk and harrow until the seed-bed is fine and firm. If the sod is spring-plowed disk and harrow immediately; or, if the area is large, harrow the same day. This holds the moisture which is so necessary to the growth of crops, especially when young. When it is desired to plant flax on land not in native or tame sod, there is no argument—it should be plowed deep, and plowed in the fall. The following spring, harrow and prepare a good seed-bed just before time to plant; then plant the flax. A firm seed-bed is imperative.

SEEDING

Flax will generally yield more satisfactory results when sown comparatively early in the spring. Farmers in western Minnesota have seeded flax as early as May 1 and as late as July 12, and obtained reasonably successful crops; but the very early- or the very late-sown crops are never certain. Under average conditions seeding from May 10 to June 1 will be found most successful. The drill is at all times advised for sowing flax for the seed crop. But care must be taken to prevent planting too deep. One inch is generally deep enough for flax. Under extreme conditions of dry and loose surface soil, planting from one to two inches deep is suggested. There is no grave danger of too deep planting on sod land but on fall-plowed stubble land, observe that the disking, if done at all, must be done early. Later it is better to harrow thoroughly instead of disking.

Half a bushel of seed per acre, of our common flax or of Minnesota No. 25, is enough, provided it is of good quality and clean. With the larger-seeded varieties, such as the yellow or golden flax, twenty-four quarts is the amount per acre recommended. If the germination is of low percentage or weak, use relatively more seed. It will not pay to use poor seed. The best is none too good.

TREATMENT OF SEED FOR WILT

It is a waste of time and money to secure good seed, and then sow it without first having treated it with formaldehyde. Wilt is a fungous disease, the germs of which live in the soil and are carried on the seed. Thus a crop may be infected by sowing flax on soil known to have been infected with wilt, unless a crop rotation or some other cropping scheme is devised whereby the flax will not appear on the same field oftener than once in from five to seven years. On the other hand a crop may become diseased by the use of seed carrying the wilt germs.

The disease attacks the plant tissues, and works mainly near the surface of the ground. When attacked, the plants turn brownish, die, dry up and crumble. If pulled, the roots appear gray as though pulled from an ash pile. Young plants are always killed; but when the stems get more or less woody before being attacked, the wilt does not always kill. It weakens the plant and often prevents the formation of seeds.

Wilt-Diseased Flax Plants

In the treatment of seed use one pint or pound of formaldehyde to forty-five gallons of water. This is essentially the treatment recommended for smuts in Extension Bulletin 14, except that in treating flax the solution must be applied as a spray. Dipping the flax into the solution is never advisable. Sprinkling with the ordinary watering pot is advised only when the holes are very small and great caution is used to guard against getting on too much water. Stir the flax rapidly with an upturned garden rake while the sprinkling is being done and do not treat more than five bushels at a time. Spread the seed thinly on a tight floor. Stop the sprinkling just as soon as all the seed is moistened. Shovel the seed into a pile and cover with a canvas or with bags for one or two hours, but shovel it over once or twice within the first half hour. If the seed begins to cake into large lumps, stir it occasionally until dry. It may be sown any time after treating in this manner. Treated seed will not prevent the wilt if it is sown on soil on which flax has recently been affected with wilt.

FLAX IN ROTATION

A large amount of organic matter in the soil is necessary for the best of success in flax culture. Nature has provided this organic matter (humus) in the virgin soils, but on lands brought under the plow, the work of nature has been dissipated. The humus has been depleted, hence the need of methods of restoring it. There are two ways of supplying humus to old soils: (1) with barnyard manure, and (2) by rotation of crops. The suggestion of barnyard manure needs no further explanation except to caution against too heavy an application, directly, for the flax crop. The various rotations of crops—or for this purpose it may better be

Suggested Rotations Including Flax

Year	5 Year system		6 Year system		7 Year system	
	Field	Crop	Field	Crop	Field	Crop
1912	I	Corn	I	Corn	I	Corn
1913	II	Grain*	II	Oats	II	Oats
1914	III	Meadow	III	Wheat*	III	Wheat*
1915	IV	Pasture†	IV	Meadow	IV	Meadow
1916	V	Flax	V	Pasture†	V	Pasture
1917	VI		VI	Flax	VI	Flax†
1918	VII		VII		VII	Wheat

*8 lbs. timothy and 6 lbs. red clover per acre sown with the grain
†Barnyard manure applied on top the soil and plowed under

said, "systems of cropping"—are not so thoroughly understood.

In practically all flax-growing areas in Minnesota, the rotations will take five, six, or seven years. In any rotation flax will do best after meadow or pasture. Suggested systems are here offered as a basis, if not otherwise wholly adaptable.

Fortunately, rotations are not rigid like mathematics; they lend themselves to the various lines of farming. Therefore a rotation for a dairy farm is different from that of a diversified farm. Each farm is a problem in itself, and is just a little different from each other farm. For answers to specific questions, write to the Division of Agronomy and Farm Management, University Farm, St. Paul, Minn.

Rotations are based upon the division of crops into grain crops, grass crops, and cultivated crops. Potatoes, therefore, could take the place of the corn, as both are cultivated crops, and any of the grain crops could be interchanged; but in arranging the sequence of crops, it should be remembered that oats are inclined to lodge if the ground is left loose, as after a potato crop. Again, wheat makes a better nurse crop than oats.

HARVESTING

The flax crop should be cut as soon as it is ripe. The manner of cutting will depend a good deal upon the machinery a man has at his command. The self-rake reaper is at present the best machine for cutting, as it leaves the bundle in handy form and loose. In the bundle it may easily be turned to facilitate drying. The less the crop has to be handled between cutting and threshing the better, especially after it has once received a rain. The binder adds to the cost of production and is likely to cause loss through shattering. If cut with the binder, the bundles should at once be set up in long two-by-two shocks. If wet by rain when in the bundles, there is some danger of loss by mold. Cutting with a mower or scythe is never advisable.

VARIETIES

Varieties of flax which produce the most seed are not large producers of fiber, and vice versa. This fact has led to the more or less indirect development of varieties suited to the one or the other purpose. The Russian Riga is regarded as a better fiber flax, while the so-called Dutch is regarded as a better seed flax. Either type, however, can be produced by selection from any common variety. The Minnesota Experiment Station has developed a very popular and high-yielding seed flax from the so-called White Blossom Dutch. This variety is known as Minnesota No. 25. From the same foundation stock a fine type of fiber flax was also secured, and called Minnesota No. 19. Owing to the lack of demand for a fiber flax this variety has not been distributed.

For the most part, in the Northwest, "flax is flax" without distinction as to varieties. As a result, selected, high-grade seed is not plentiful. In 1904 the Minnesota Experiment Station distributed several hundred bushels of Minnesota No. 25 flax, to 270 farmers. Reports from 48 of these farmers showed for No. 25 an increase of 3.1 bushels per acre, or 26 per cent over the common varieties grown under similar conditions. In comparison with varieties obtained from seedmen, a three-year test gave Minnesota No. 25 an average of 19.3 bushels per acre, while the commercial seed yielded from 14.4 to 16.3 bushels per acre.

Minnesota No. 25 is very uniform in growth and maturity, a strong grower and high yielder. Farmers should secure seed of this variety.

SUMMARY

1. Flax is not "hard on the land" when compared with average yields of other crops.

2. Flax should not be grown oftener than once in from five to seven years.

3. Flax-wilt germs are carried with the seed, and live from year to year in the soil. The formaldehyde treatment will disinfect the seed.

4. Flax can be successfully grown on old lands when properly handled. Do not sow flax on flax-sick soil.

5. Early planting is safest in the long run.

6. A firm seed-bed is necessary.

7. Harvest the crop when it is ripe. Thresh or stack as soon as possible when flax gets dry.

8. In rotation flax should follow grass. A large amount of humus is necessary in the soil.

9. Minnesota No. 25 is the best variety to grow.

10. The Northwest should grow more flax.

EXTENSION BULLETINS

The following Extension Bulletins have been published, and will be sent to any resident of Minnesota, free of cost, on request. If carefully filed away, they will in time form a valuable library for reference, on farm topics.

1—Farmers' Clubs in Minnesota*
2—Lists of Agricultural Books and Available Bulletins*
3—Industrial Contests for Minnesota Boys and Girls
4—Potato-Growing in Minnesota*
5—Woman in the Life on the Farm*
6—Clover*
7—Pork Production
8—Poultry Houses*
9—Selecting and Storing Seed Corn
10—Care and Management of the Dairy Herd
11—Dressing and Curing Meat for Farm Use
12—Feeding Dairy Cows†
13—Farm Drainage
14—The Smuts of Grain Crops
15—Cost of Horse Labor
16—Small Fruits on the Farm
17—The Farm Vegetable Garden
18—Alfalfa-Growing in Minnesota
19—Domestic Science in Rural Schools
20—Soil Tillage
21—The Care and Management of Poultry
22—Establishing the Orchard
23—Some Common Insects and Their Control*
24—Seed Testing
25—Annual Pasture, Soiling and Hay Crops
26—Seed Grain
27—Flax-Growing
28—Tuberculosis
29—The Keeping of Dairy-Cow Records
30—Marketing Eggs From the Farm
31—Dressing and Marketing Veal and Poultry
32—Tuberculosis of Cattle
33—Some Knots and Splices
34—Bundle-Corn and Beef Production
35—Potato Diseases
36—Egg-Marketing
37—Hog Cholera
38—Potato Growing in Minnesota
39—Minnesota Seed Law
40—Preservative Treatment of Fence Posts
41—Two Types of Silos
42—Cooperative Creameries and Cheese Factories
43—Flies and Their Control
44—Barnyard Sanitation
45—Mutton

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*Out of print
†Superseded by Experiment Station Bulletin 130